CLAIMS

We claim:

[c1]   1.   A method of frequency estimation for a GSM communications system comprising:

(a)   receiving a frequency control channel data burst;

(b)   sampling said data burst into a plurality of subsets;

(c)   filtering at least one of said plurality of subsets to generate a filtered subset;

(d)   correlating each filtered subset and summing the result into a parameter r;

(e)   updating a filter parameter of said filter using the parameter r;

(f)   repeating steps (c) – (e) N iterations; and

(g)   calculating an estimated frequency based upon the parameter r.

[c2]   2.   The method of Claim 1 wherein said filtering is performed on each of said plurality of subsets.

[c3]   3.   The method of Claim 1 wherein said filtering is by use of an auto-regressive filter.

[c4]   4.   The method of Claim 3 wherein said auto-regressive filter is a one-pole filter.

[c5]   5.   The method of Claim 2 wherein said filtering is by use of an auto-regressive filter.

[c6]   6.   The method of Claim 1 wherein said estimated frequency is calculated by:

$$f = \frac{f_s}{2\pi} \cdot \frac{\angle r}{m}$$

where f is the estimated frequency, f_s is data frequency of said frequency control channel data burst, and m is an interval of correlation.

[c7]   7.   The method of Claim 1, wherein said filter parameter is determined by:

$$a(k) = \beta \, e^{j \cdot \frac{\angle r}{m}}$$

where β is a forgetting factor and m is an interval of correlation.

[c8]   8.   The method of Claim 1 wherein said parameter r is determined by:

$$r = \sum_k \sum_q y_k(q+m) \cdot y_k^*(q)$$

where q is the number of elements in said sampled subsets and m is an interval of correlation.

[c9]   9.   An apparatus for frequency estimation in a GSM communications system comprising:

     (a)   means for receiving a frequency control channel data burst;

     (b)   means for sampling said data burst into a plurality of subsets;

     (c)   means for filtering at least one of said plurality of subsets to generate a filtered subset;

     (d)   means for correlating each filtered subset and summing the result into a parameter r;

(e)   means for updating a filter parameter of said filter using the parameter r;

(g)   means for calculating an estimated frequency based upon the parameter r.

[c10]   10.   The apparatus of Claim 9 wherein said means for filtering is performed on each of said plurality of subsets.

[c11]   11.   The apparatus of Claim 9 wherein said means for filtering is an auto-regressive filter.

[c12]   12.   The apparatus of Claim 11 wherein said auto-regressive filter is a one-pole filter.

[c13]   13.   The apparatus of Claim 10 wherein said means for filtering is an auto-regressive filter.

[c14]   14.   The apparatus of Claim 1 wherein said means for calculating an estimated frequency operates by:

$$f = \frac{f_s}{2\pi} \cdot \frac{\angle r}{m}$$

where f is the estimated frequency, f_s is data frequency of said frequency control channel data burst, and m is an interval of correlation.

[c15]   15.   The apparatus of Claim 9, wherein said filter parameter is determined by:

$$a(k) = \beta\, e^{j \cdot \frac{\angle r}{m}}$$

where β is a forgetting factor and m is an interval of correlation.

[c16]   16.   The apparatus of Claim 1 wherein said parameter r is determined by:

$$r = \sum_k \sum_q y_k(q+m) \cdot y_k^*(q)$$

where q is the number of elements in said sampled subsets and m is an interval of correlation.